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Task Y-R007-08-003  
Type B

Technical Note N-467

CELLULAR GLASS INSULATION FOR UNDERGROUND HOT LINES

15 October 1962

by:  
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Port Hueneme, California

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ABSTRACT

One-hundred-and-ninety feet of 6-inch pipe used to carry steam condensate was installed with Foamglas insulation at the U. S. Naval Shipyard, San Francisco, California, during May 1962. Installation was made to evaluate the performance of Foamglas with particular attention given to improving the quality, efficiency and economy of installation techniques.

The competitive position of Foamglas with regard to installation cost can be improved by eliminating: (1) the water cut-off collars if there is assurance that there would be no leaks resulting from internal corrosion; (2) the cement coating of the insulation bore; (3) the buttering of the butt and longitudinal joints; and (4) the staggering of the sections of insulation. Improving the design of the expansion loop would also aid in reducing costs.

Measurements of the temperature difference across the insulation indicated that Foamglas was satisfactory as a thermal insulator. The effectiveness of Foamglas as a moisture barrier is supposedly very good, but it will not be possible to check this property as the water table is below the pipe most of the time.

## INTRODUCTION

The Navy is constantly looking for new materials which may be better than it now uses. One application in which a better material would be desirable is the thermal insulation for underground hot pipelines.

An insulating material should have a low thermal conductivity but more important it should prevent pipe corrosion by being a barrier to the moisture in the ground. It is not difficult to fabricate a material with an acceptable thermal conductivity, the difficulty is that most materials inherently are not effective moisture barriers, that is, it is possible for ground water to penetrate the insulation. Metal sheaths are placed around some types of insulations, but these sheaths are effective only if they do not corrode.

During the past several years, a different type of material known as "Foamglas" has been gaining attention as a pipe insulator. This material is manufactured by the Pittsburgh Corning Corporation. Foamglas is glass processed in a manner which forms myriads of small, closed cells. It is very light in weight and is impervious to water, has a reasonably low thermal conductivity, and resists alkali, acid, oil, fungus, insects and vermine.

Being impervious to water, Foamglas appears to overcome the difficulties inherent in insulation systems having a moisture barrier problem. Under the sponsorship of BuDocks, the Naval Civil Engineering Laboratory, Port Hueneme, California, is undertaking a series of tests to evaluate the performance of this material. This report discusses some of the improvements that can be made in the installation methods and techniques and discusses briefly the insulation effectiveness of Foamglas. Because the water table is below the pipe most of the time, it will not be possible to evaluate Foamglas, as installed, for moisture barrier effectiveness.

## DESCRIPTION OF THE INSTALLATION

Initially, Foamglas is being tested at the U. S. Naval Shipyard, San Francisco, California. Additional tests at other locations are contemplated. The installation at San Francisco was made during May 1962 on a new steam condensate pipe, and was done by the shipyard personnel with technical guidance by the Plant Asbestos Company, the retail outlet for Foamglas in the area.

to squeeze through the mesh of the tape as shown in Figure 7. A second coat of mastic was applied, using about a gallon per 25 square feet of surface. This coat was followed by another spiral wrap of glass fabric and then a final finishing coat of mastic about 1/8 inches thick. All of the mastic was applied by hand.

An attempt was made to determine how long it took to do the various portions of the job. This undertaking proved to be impractical, however, because the newness of the job caused several delays which would not be expected to occur after regular procedures have become established.

#### THERMOCOUPLES AND TEMPERATURES

Two thermocouples were located at each end of the trench, at Spear Avenue and at Building 203. One was welded to the pipe and a second was placed on the outer surface of the Foamglas and under the mastic coatings. Temperature readings are taken between 0930 and 0945 once a week. Those taken thus far are given in Table 1 below.

Table I. Temperature of Pipe and Outside of Foamglas

Date	Spear Ave.		Building 203	
	Pipe	Foamglas	Pipe	Foamglas
25 Jun 1962	153 F	113 F	153 F	107 F
2 Jul	187	124	150	127
9 Jul	179	116	171	120
16 Jul	192	116	185	130
23 Jul	205	118	197	132
30 Jul	189	123	189	137
6 Aug	188	122	159	124
13 Aug	187	121	180	127
20 Aug	190	124	163	132

Based on the foregoing Table I, the average temperature across the insulation was 67.0 F at Spear Avenue and 45.7 F at Building 203. The above temperatures were taken after the trench had been backfilled.

Foamglas would be improved. The following are submitted as candidates for elimination.

a. Water Cut-Off Collars

The water cut-off collars can be eliminated if there is assurance that there would be no leak resulting from internal corrosion. The galvanizing burns off when the half-sections of the collar are welded together and then to the pipe. The collars can be given a coating of zinc chromate primer but this treatment adds to the cost of the job. Without galvanizing or primer the collars would quickly rust if there were leaks. Internal corrosion is usually a problem only with condensate pipes, steam pipes generally are not affected.

b. Bore Coating

A coating is considered necessary only if the pipe is subjected to vibration.

c. Joint Buttering

The outer coatings of mastic should be adequate to prevent the entrance of ground water. Several stress cracks developed in the insulation (Figure 11), and if only the cement between the joints were depended upon to stop leaks, the pipe would still be vulnerable to leaks through the stress cracks. These cracks are normal and the number occurring increases as the temperature of the pipe increases, but the use of mastic should prevent leakage both through these cracks and through the joints.

d. Section Staggering

e. Bands on 9-inch Centers

It is considered that one band per section of insulation should be adequate.

It should be pointed out that, according to the manufacturers' representatives of Foamglas, in the San Francisco area, including Treasure Island installations, the SFNS installation is the only one requiring the steps outlined in items (a) through (e) above.

The insulation at the expansion loop was difficult to install. Many of the sections were broken apart at the glue joints, probably caused by pre-job handling, and the pieces had to be held together while putting on the bands. This procedure was especially awkward because the sections had to be staggered. It was also difficult

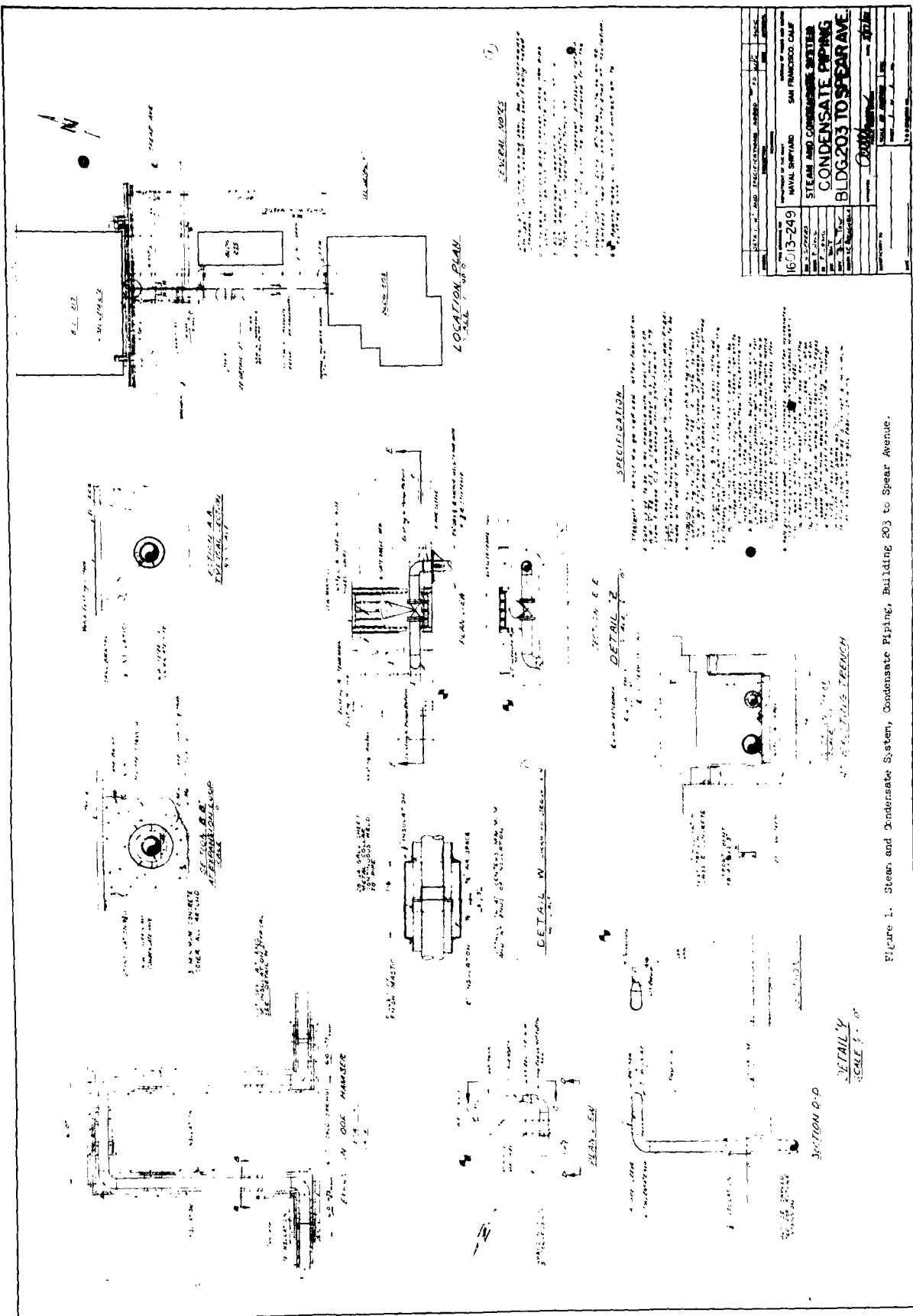


Figure 1

Figure 1. Steam and Condensate System, Condensate Piping, Building 203 to Spear Avenue.

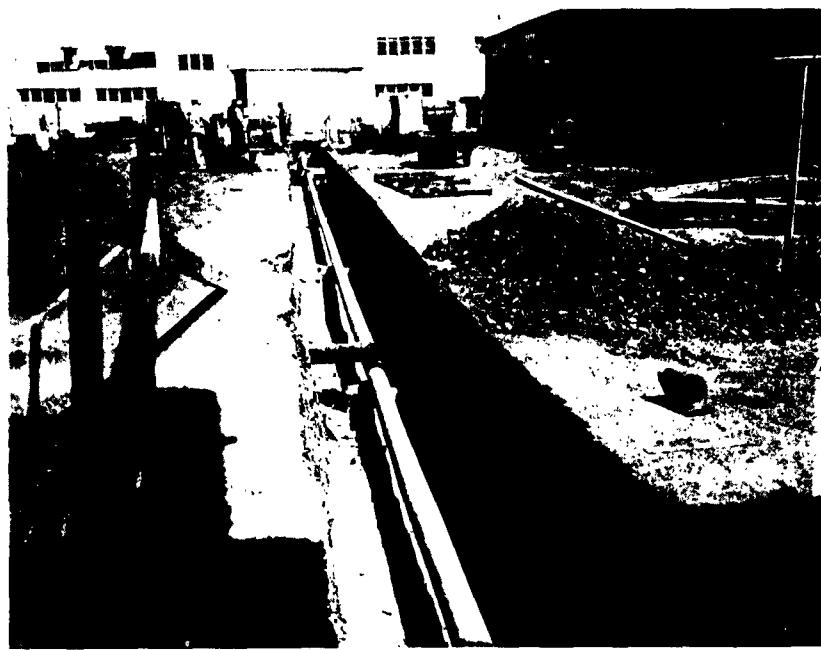


Figure 2. Six-inch steam condensate pipe ready for insulation.



Figure 3. Workman welding sheet metal collars onto pipe.



Figure 4. Coating the core and buttering the joints of Foamglas insulation.



Figure 5. Installing the Foamglas insulation.



Figure 6. The expansion loop with Foamglas insulation in place.

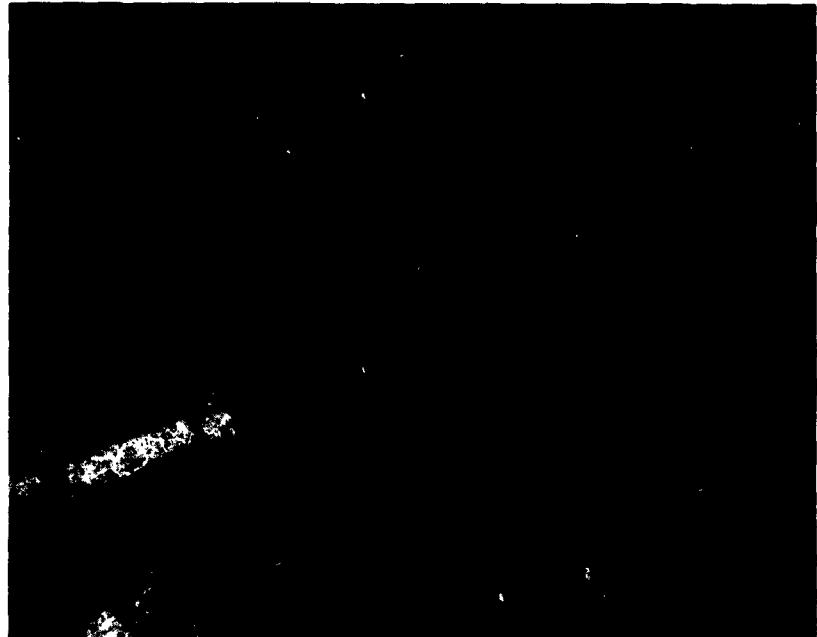


Figure 7. Workman is wrapping Foamglas insulation with glass fabric tape following the first tack coat.



Figure 8. Foamglas has good compressive strength.



Figure 9. The trench is backfilled with sand.

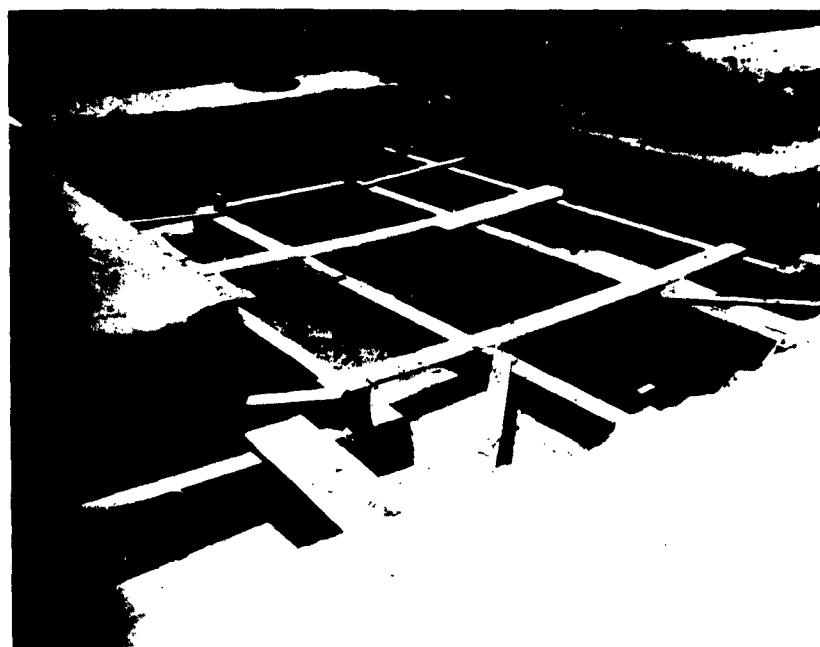


Figure 10. The loop is backfilled with Portland Cement concrete.

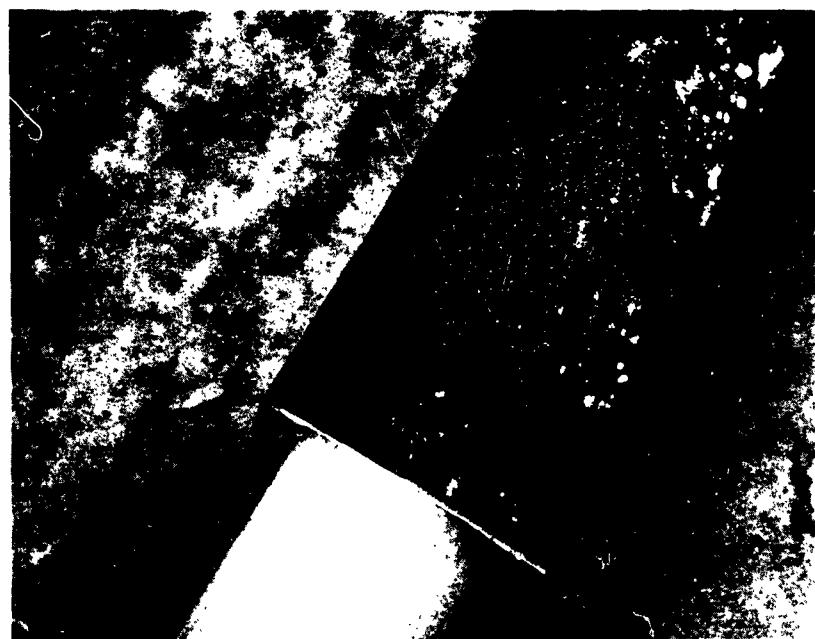


Figure 11. A typical stress crack.

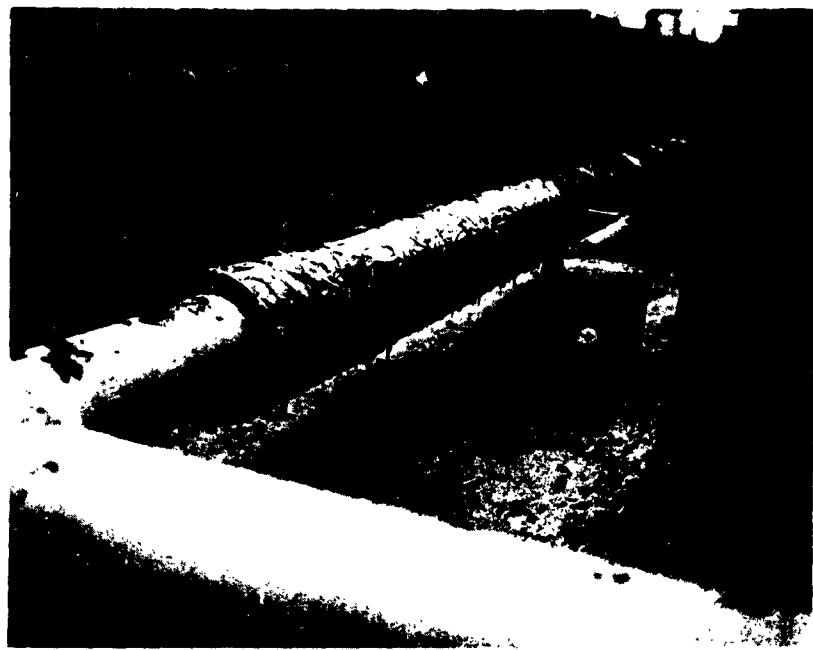


Figure 12. Final coating of Bitumastic 50. Note flow from vertical surfaces and streamers from bottom.



Figure 13. Sealkote being applied to loop piping.